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Measurement of a wide-range of X-ray doses using specialty doped silica fibres

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Abstract

Using six types of tailor-made doped optical fibres, we carry out thermoluminescent (TL) studies of X-rays, investigating the TL yield for doses from 20 mGy through to 50 Gy. Dosimetric parameters were investigated for nominal 8 wt% Ge doped fibres that in two cases were co-doped, using B in one case and Br in the other. A comparative measurement of surface analysis has also been made for non-annealed and annealed capillary fibres, use being made of X-ray Photoelectron Spectroscopy (XPS) analysis. Comparison was made with the conventional TL phosphor LiF in the form of the proprietary product TLD-100, including dose response and glow curves investigated for X-rays generated at 60 kVp over a dose range from 2 cGy to 50 Gy. The energy response of the fibres was also performed for X-rays generated at peak accelerating potentials of 80 kVp, 140 kVp, 250 kVp and 6 MV photons for an absorbed dose of 2 Gy. Present results show the samples to be suitable for use as TL dosimeters, with good linearity of response and a simple glow curve (simple trap) distribution. It has been established that the TL performance of an irradiated fibre is not only influenced by radiation parameters such as energy, dose-rate and total dose but also the type of fibre. (C) 2016 Elsevier Ltd. All rights reserved.

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